Cysticercus tenuicollis: A New State Record For Ohio[1]

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ABSTRACT. *Cysticercus tenuicollis* (*Taenia hydatigena*) is reported for the first time from Ohio. The parasite was found in a high density, enclosed population of white-tailed deer (*Odocoileus virginianus*). As many as 138 individuals per km^2 have been reported for this herd. When deer from western Pennyslvania were examined, this parasite was not found. Infection of deer with *C. tenuicollis* has been reported in Michigan.

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INTRODUCTION

Cysticercus tenuicollis is the larval stage of the tapeworm, *Taenia hydatigena* Pallas (synonym *T. marginata*), order cyclophyllidea, family Taeniidae. This cestode has been found in a large number of hosts throughout the world. We encountered *Cysticercus tenuicollis* in white-tailed deer (*Odocoileus virginianus*) at the Plum Brook U.S. Government Reservation, located 5 km south of Sandusky, Ohio. The enclosed white-tailed deer herd at the Plum Brook Station is an important resource. Over 7,000 deer have been removed from the herd (Palmer et al. 1980), with many of these deer being used for stocking programs and research studies. Plum Brook was a military munitions center constructed during World War II. A 2.44-m-high, chain-link fence was erected in 1942 to enclose 2,176 ha. Maintenance of the security fence has prevented deer from entering the enclosed area since that time. The National Aeronautics and Space Administration (NASA) assumed control of Plum Brook from the United States Army in 1956.

A count of the deer enclosed at Plum Brook in 1958 estimated the number of animals at over 100 but less than 200. In September, 1975, the enclosed deer herd was estimated at 3000 animals (confidence interval of 0.95) by analysis of aerial photographs (Lamvermeyer 1976). This is a density of 138 deer per km^2. During the present study, the deer population was obtaining a major portion of its food by grazing grass; browse was overused and insufficient for the deer. Because the extent of parasitism needs to be determined for optimum deer management, we initiated a study of the internal parasites infecting these animals.

METHODS

White-tailed deer (*Odocoileus virginianus*) were sacrificed by U.S. Fish and Wildlife Service (USFWS) personnel at the Plum Brook NASA Station. The deer were taken for a study of blood physiology and general health of the deer herd. The carcasses of the animals were examined for parasites within 20 min after death. Necropsy of these animals was modified from the methods of V. F. Nettles (Davidson et al. 1981). The trachea and lungs were examined for lung worms; the cranial vault was opened to examine the meninges and venous sinuses for meningeal worms; the liver was removed and cut into 0.5-cm slices to reveal flukes or bladderworms; and the great omentum and peritoneum were examined for both parasites and quantity of body fat. The digestive tract was removed, and the parts were separated and opened. The contents and mucosa were examined for nematodes, cestodes, or trematodes. Cysticerci were removed when encountered and preserved for sectioning to make microscopic slides of the scolex region for identification (Verster 1969).

Following the discovery of *C. tenuicollis* at Plum Brook, we examined 21 hunter-killed deer for parasites in western Pennsylvania. Examination of these animals was truncated to a search of body cavity, viscera, peritoneum, lungs, and liver. Since these were hunter-killed deer, we could not remove the heads to examine for brain worms. The Fisher Exact Test (Zar 1984) was used to determine if the parasite populations were comparable between the Plum Brook deer and the deer of western Pennsylvania. The original test, using calculated contingency comparisons, was employed because it is most appropriate for these data.

RESULTS

A total of 30 deer were examined at Plum Brook. Those found infested with *C. tenuicollis* are described in Table 1. The host for the adult worms at Plum Brook may be the red fox, *Vulpes vulpes*, because it is taken occasionally in the box traps employed to capture deer. Other species reported to serve as definitive host for this worm are not present at Plum Brook to our knowledge. No other cestode species (as larvae or adults) was encoun-

TABLE 1

Deer infected with Cysticercus tenuicollis *at the Plum Brook NASA Station.*

Sex	Age (yr)	Infection	Host condition
Male	1.5	1 large cysticercus	Fat
Female	1.5	1 cysticercus	Barren doe
Female	3.5	4 very large cysticerci	Pregnant with 2 fawns
Male	1.5	Numerous, small cysticerci in liver	Normal
Male	2.5	7 large cysticerci on great omentum	Fat
Female	2.5	1 large cysticercus in peritoneal cavity	Pregnant with 1 fawn

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tered among the Plum Brook deer. Trematodes, lung worms, and brain worms were not observed. The deer were remarkably free of parasites.

The deer from western Pennsylvania were all free of *C. tenuicollis*. No lungworms, trematodes, or other tapeworm species were found in the individuals. A filarial worm, *Setaria yehi,* was encountered occasionally in the deer from Plum Brook, but was absent in the Pennsylvania sample. The presence of this worm in the Plum Brook deer is not unexpected as Schurr and Rabalais (1983) found *S. yehi* infecting deer in the area near the Plum Brook NASA Station. These filaria are transmitted by blood-sucking diptera, and a chain-link fence would be no barrier to these vectors.

The Fisher Exact Test, used to compare the parasite loads between the 30 deer from Plum Brook and the 21 deer from western Pennsylvania, gave a 0.95 confidence interval that these were two different populations.

DISCUSSION

This is the first report of *Cysticercus tenuicollis* from Ohio. White-tailed deer have entered northwestern Ohio to repopulate an area where they were extirpated late in the last century (Lamvermeyer 1976).

The relative absence of parasites in both the Plum Brook and western Pennsylvania deer samples can be explained by the advancing population hypothesis of Chiang (1961), which states that an expanding fringe population of animals tends to outdistance parasites. As time passes, it is to be expected that the parasite populations will follow, and that eventually the deer will support parasitic infections commonly found where the deer originated. McNeil (1962) documented the movement of deer from southern Michigan into northwestern Ohio. There are no barriers to expansion of deer populations from Michigan to the Plum Brook Station. *Cysticercus tenuicollis* has been reported from Michigan; it has not been documented from western Pennsylvania (the other probable source for the Plum Brook deer herd). We found no *C. tenuicollis* among western Pennsylvania deer coexisting at the same time as the deer samples taken at Plum Brook. The distance to Plum Brook from Pennsylvania is considerably greater than the distance from Michigan. Although all of these facts tend to indicate Michigan as the most probable source of the Plum Brook deer herd and the *C. ternuicollis* infecting them, the most compelling evidence is the scientific literature that documents expansion of the range of *C. ternuicollis*.

From an Old World center of distribution, there has been an expansion in the range of *T. hydatigena-C. tenuicollis* into Alaska, Canada, and from there southward into the western United States and eastward into the Montreal, Canada area and the New England region. Priestwood (1971), Sweatman and Plummer (1957), and Cheatum (1951) confirmed that the white-tailed deer is a relatively new host species for *C. tenuicollis,* and that deer are not perfect hosts for this parasite.

Sweatman and Plummer (1957) noted that "*T. hydatigena* is encountered throughout the world, but, even so, remarkably little has been written on its biology." Since 1957, there has been very little effort focused on the study of this parasite. The genetics and physiology of parasitic systems are being recognized as fertile areas of research (Sidhu, 1984). *Cysticercus tenuicollis* and *T. hydatigena,* in their various hosts, represent an interesting model worthy of intensive investigation. It is noteworthy that the Plum Brook deer herd is conveniently located for researchers in Ohio. Initial studies of genetics and blood physiology have already been completed in this confined deer population (Lamvermeyer 1976). The discovery of *C. tenuicollis* in Ohio not only documents one more step in the expansion of the range of this parasite, but also offers a rare opportunity to study host-parasite interactions of a cestode species capable of employing many hosts in its life cycle.

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